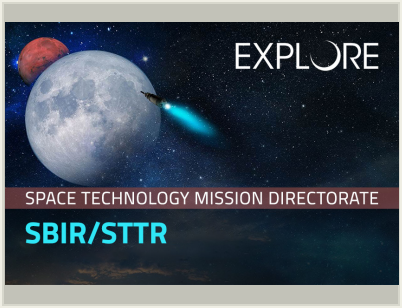
Optical Approach to Augment Current Float Sensing Method of Determining Cryogen Fluid Height Within a Tank, Phase I

Completed Technology Project (2011 - 2012)

Project Introduction

Innovative Imaging and Research, a small technology development company, has teamed with the University of Southern Mississippi Instrument and Cryogenics Research Laboratory to integrate existing NASA Stennis Space Center heritage cryogen level monitoring technology with noncontact optical methods and advanced signal processing to create a 21st century liquid cryogen level measurement technique. We propose to place a fiber-optic laser range finder on the upper surface of a low pressure cryogen run tank and use the existing Hall effect float system as an optical target to reflect the light signal back to the range finder. We also propose combining measurements obtained with the fiber-optic range finder with those taken by the heritage system using a custom Kalman filter signal processing algorithm to reduce measurement noise and increase overall accuracy. Our optical technique has several advantages over the existing Hall effect method. It yields near continuous measurements and is not dependent on the location of individual sensors. It is based on an alternate physics approach and therefore yields completely independent results. The optical range finder instrument calibration is performed outside the tank, so test operation is not significantly impacted and run tanks do not need to be emptied. In addition, an optical fiber mounted on the upper surface of a cryogen tank does not present foreign object debris (FOD) concerns. During our Phase 1 STTR project we will demonstrate our concept in a university cryogen research laboratory using a commercial optical range finder. In Phase 2 we plan to demonstrate our concept with fiber-optic technology using the SSC Instrument Test Apparatus under a NASA Space Act Agreement. Our Phase 1 concept is at a technology readiness level (TRL) of 2. We expect to complete Phase 1 at a TRL of 4 and complete Phase 2 at a TRL of 6.



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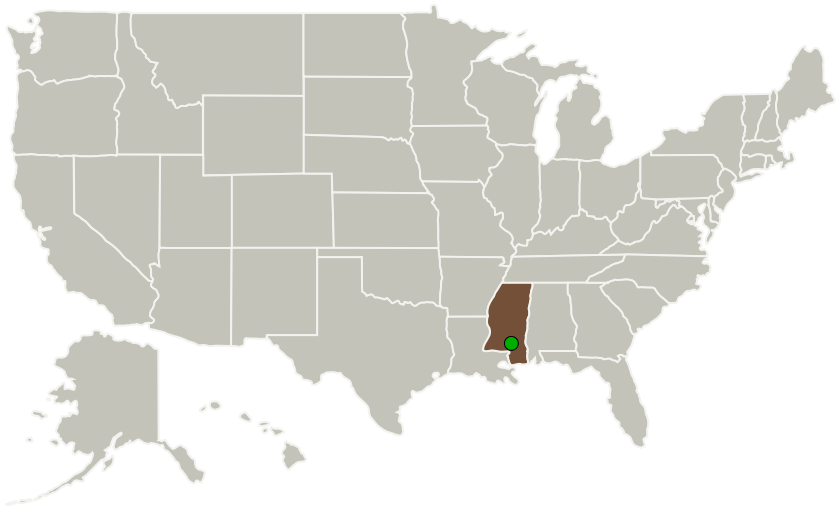
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Innovative Imaging and Research Corporation	Lead Organization	Industry Women-Owned Small Business (WOSB)	Stennis Space Center, Mississippi
Stennis Space Center(SSC)	Supporting Organization	NASA Center	Stennis Space Center, Mississippi
University of Southern Mississippi	Supporting Organization	Academia	Hattiesburg, Mississippi

Primary U.S. Work Locations
Mississippi

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Innovative Imaging and Research Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Robert E Ryan

Co-Investigator:

Robert E Ryan

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Project Transitions

February 2011: Project Start

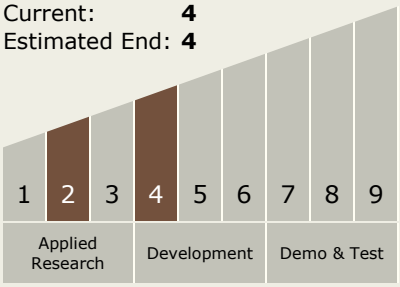
February 2012: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138392)*

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.1 Cryogenic Systems
    - TX14.1.2 Launch Vehicle Propellant

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System